

Gulf of Maine Atlantic herring tagging project – Annual Report for 2002

Maine Department of Marine Resources (DMR)

Overview



Atlantic herring (*Clupea harrengus*) is one of the most biologically and economically important species in the Gulf of Maine. Herring are oceanic plankton-feeding fish that occur in large schools, inhabiting coastal and continental shelf waters from Labrador to Cape Hatteras. Adults (age 3+) migrate south from summer/fall spawning grounds in the Gulf of Maine to over-winter off southern New England and the Mid-Atlantic states. Important commercial fisheries for juvenile herring (ages 1 to 2) existed from the 19th century through the 1980's along the coasts of Maine

and New Brunswick. The development of large-scale fisheries for adult herring is comparatively recent, primarily occurring seasonally in the Gulf of Maine, on Georges Bank, and in southern New England and Mid-Atlantic waters. In addition to their commercial value herring are an important food source for many species of fish, mammals, and seabirds. Commercial landings are currently around 200 million pounds with 60 percent going to the lobster bait market and 40 percent to canneries and freezer plants.

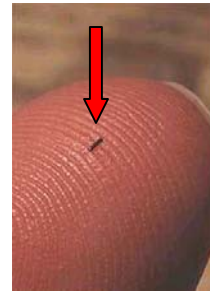
There have been several Atlantic herring tagging projects in the past; however, the herring fishery has changed a great deal since the last tagging effort in US waters (1970-1982). Mobile gear (purse seine and mid-water trawl vessels) fishing pressure on the inshore stock component has increased, herring have moved further from coastal waters, and the Georges Bank stock component has recovered from its collapse of the 1960's. A new herring tagging project has the potential to provide information on fishing mortality, spawning site fidelity, stock intermixing and migration patterns.

Project Description

Atlantic herring may have the most complex stock structure of any marine fish (Iles and Sinclair 1982). Traditionally three stocks of herring were recognized in the Gulf of Maine region, and within in each of these are a presumed number of discrete spawning units. For management purposes, the U.S. stocks are assessed together as one unit. The stock assessment (27th SAW 1998) currently integrated into the fishery management plans concluded that the US Atlantic coastal herring stock complex is "large and underutilized". The fishing mortality (f) of the coastal stock complex is estimated at less than .10, well below the target fishing mortality of .25. However, an exploratory analysis conducted in 2000 indicated that the inshore Gulf of Maine stock component is fully exploited with a potentially unsustainable fishing mortality estimate of .35 (Stevenson 2000). In order to address research objectives proposed by the New England Fishery Management Council and the Atlantic States Marine Fisheries Commission a tagging

project was designed in 2001 to assess stock discreteness, exploitation rates and reevaluate catch allocations.

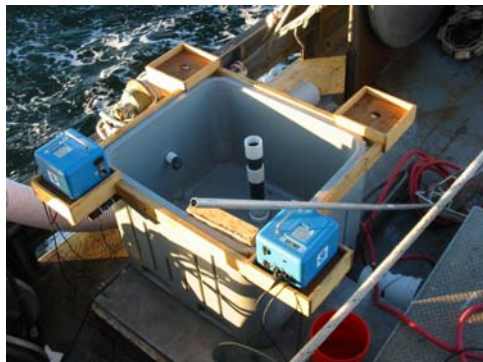
Microwire tags were selected as the best option for marking herring, because they are less invasive, result in high retention rates and automated tag detection is capable of being integrated into bulk processing facilities.



Through the generous support of the herring industry (fishermen, dealers and processors) and equipment loans from the National Marine Fisheries Service (NMFS), DMR was able to initiate a coded wire tagging pilot project in 2001. This pilot project was expanded in 2002 to include a second recovery site at the Stinson's 2001 Ltd. processing facility in Prospect Harbor and the implementation of a full scale tagging initiative in the Gulf of Maine. Project activities centered around four major areas in 2002: field methodology, live herring transportation, tag recovery and funding.

1. Field Methodology

Preparation for the summer field season began in April with equipment purchases. The main focus was designing and constructing live fish holding tanks that could be used for vessel based tagging trips and overland transportation. Two insulated, 3x4x4' xactix boxes were modified by incorporating a standpipe, drainage hole, and inlet/outlet linkages for connection to a submersible pump. A tagging platform was also constructed to fit around the xactix box, providing a suitable working surface. This design allowed herring to be kept in excellent condition while waiting to be tagged and released on board commercial fishing vessels. These modified tanks also allowed herring to be transported over-land to the Boothbay Harbor laboratory.

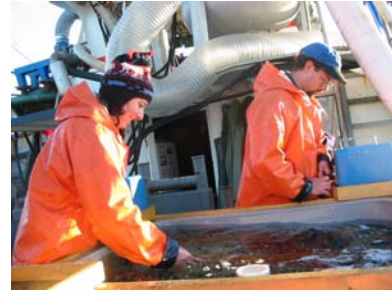


Field tagging events occurred over the course of the late summer and fall in the Gulf of Maine. DMR personnel spent 20 days on board herring purse seiners in an attempt to tag and release live fish from pre-spawning aggregations. Unfortunately, herring were only successfully tagged on 2 of these trips because of fish availability and size distributions. Tagging herring from a purse seine platform followed the established protocol described below.

1. The seine was set and dried up until about $\frac{1}{2}$ of the net remained in the water. At this point herring generally started schooling near the starboard side of the vessel.
2. Herring schooling near the vessel were dip-netted out of the seine and put into the modified xactix tanks. Numbers of herring in the tank ranged from 50-500 during tagging operations, however 300 seemed to be an ideal concentration. Herring were generally not netted out of the "pocket" and transferred to the holding tank. The survival

rate for fish at this stage of the harvesting process was determined to be extremely low because of the increased stress and significant scale loss.

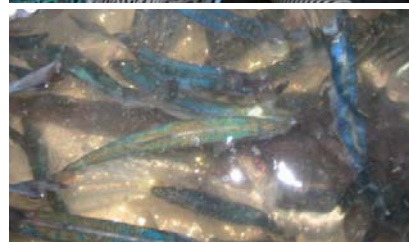
3. Herring were handled individually with bare hands, which seemed to result in minimal damage to the fish. Tagged fish were selected for fitness and percent scale cover. Generally herring with more than 20% scale loss were not tagged because of an assumed high incidence of delayed mortality.
4. Tagged herring were immediately released over the port side of the vessel. Predation did not appear to be a significant problem if tagging operations took place at night.



Over the course of the season more than 2,000 fish were tagged on purse seine vessels. The number of fish tagged per set ranged from 75 to 900, averaging 500 fish per hour under ideal conditions.

In addition to tagging herring from purse seine vessels in 2002, a method was developed to capture live herring with mid-water trawl gear. An aquarium codend was borrowed by DMR from NMFS and trialed for three days. The procedure was as follows:

1. Aquarium codend was secured to the existing codend of the mid-water trawl net.
2. The unit was filled with water and then deployed. The net was set in a normal fashion and fished for 10-20 minutes at a shallow depth (6-10 fathoms).
3. The net was brought back onto the vessel and the aquarium codend was opened. Herring were tagged directly from the aquarium codend and released immediately.



Atlantic herring captured in this manner were generally in good condition although a higher percentage had significant scale loss in comparison to seine caught fish. Fish quality depended largely on how long the aquarium codend was fished and how many herring were caught. Catches with the highest quality of live fish were on the order of 500-600 individuals caught in less than 10 minutes. Catches with 1,000 fish had to be sorted through more than the smaller catches and about $\frac{1}{2}$ of the fish were discarded without tags due to scale loss. Despite some variations in fish quality more than 2,000 herring were tagged using this method. This result compares favorably with the purse seine method of obtaining live herring for tagging.

Based on the success of these trials, DMR had a new aquarium codend built for use during the 2003 field season. Having a capture method that can be used with mid-water trawl gear is important because it allows the program to expand into southern New England during the winter herring fishery where conditions are not generally conducive to purse seining. Employing two capture methods for the tagging project affords the flexibility necessary to successfully obtain herring in a variety of seasonal and environmental conditions.

2. Live Herring Transport

Although several attempts were made between June and August of 2002 to get live herring back to the DMR lab, none were successful. The most promising technique tried was flooding a fish hold on a herring vessel and transporting the herring to the dock. Once the vessel was in port the herring were transferred into modified xactix tanks with circulators and oxygen. The herring were then driven to the lab and put into large circular tanks. Initial mortality was on the order of 25% and reached 100% after the first 24-hour period. Several more attempts were made using various methods, but none of them were successful.

A tagging mortality study is being considered for 2003 using a weir to contain the study group for short periods of time. This study will be a collaborative effort between the Department of Fisheries and Oceans in St. Andrews, New Brunswick and DMR.

3. Tag Recovery

Two automated detection units were purchased in 2001-2002 and transported to the Connor's Brothers Ltd. processing facility in Blacks Harbour, New Brunswick. The engineers at Connor's



Brothers designed and constructed conveyor systems that incorporated the detection units into the processing lines at a point where tags could be retrieved. After the modified conveyor lines were installed at the Bath and Prospect Harbor plants, several repairs and modifications were made. As soon as the units were operating predictably testing was conducted, showing that tag recovery within the plants ranged between 80-100%.

Unfortunately, the coded-wire tagging project experienced a significant setback when both detection units were damaged during the course of normal plant operations. Several attempts were made to repair the units at the plants, however after the units were reinstalled test trials revealed electronic problems caused by moisture in the detectors. Both units were sent back to Northwest Marine Technologies (NMT) for repair. Regrettably, only one unit could be reconditioned while the other was a total loss.

4. Project Funding

Initial funds were secured for a herring tagging pilot study in 2001. With the successful completion of that pilot study new funding sources were secured in 2002 for a fully implemented tagging project. Primary funding came from a joint grant awarded to the Gulf of Maine Aquarium and DMR by the Northeast Consortium. This grant supported work on both the Atlantic herring inshore acoustic program and the coded-wire tagging project. The funds were allocated for 28 days of contracted vessel work, the hiring of a shared field assistant and the purchase of equipment. Several other grants awarded in 2001 for the tagging project are long-term and will continue to be carried over on an annual basis until they are spent. Funding goals in 2003 will focus on securing a salary for a seasonal field assistant.

Results and Conclusions

DMR began a major review of the coded-wire tagging project after the loss of one of the recovery units. The destruction of this unit represented a significant setback to the project both financially and functionally. The following concerns with the coded-wire tagging project were raised and discussed during a comprehensive evaluation of the project.

1. The detection units require continual supervision to run properly. DMR and the industry did not feel that permanent staffing for each unit could be achieved.
2. Significant problems were occurring with the detection units giving false positive results. As many as 5 false recoveries were made an hour during fish processing. This resulted in large volumes of fish (10-20 lbs per sample) that needed to be sorted and tested to determine the source of the positive readings.
3. Only fish processed in the canneries were being scanned. Because the coded-wire tags are internal, recoveries could not come from any other sector of the fishery. Although other companies expressed interest in installing detection units, the cost (\$20,000) and installation procedures (requires engineering expertise and \$5,000-\$10,000) are major challenges. For these reasons, the future expansion of this type of tagging project seemed limited.

In consideration of these issues, DMR, Stinsons 2001 Ltd. and various industry members decided that there were three available courses of action (see Appendix). After consideration of each option, DMR decided to abandon the coded-wire tagging project and initiate a more conventional spaghetti tagging program for Atlantic herring. This project will begin in the spring of 2003 and will incorporate most of the equipment and expertise gathered for the work conducted in 2002.

Acknowledgements

DMR would like to thank the captains and crews of the F/V Western Sea, F/V Western Wave, F/V Thunder Bay, F/V Ocean Venture and the F/V Western Hunter for providing their vessels as tagging platforms. Although some of the tagging work was done under contract, several vessels also allowed DMR staff to work during commercial trips. We would like to thank the staff and

management at Connors Brothers Inc. and Stinson's 2001 Ltd. for their support in designing and installing the recovery units. Many other industry members contributed to this project by offering advice and expertise that were greatly appreciated.

The Gulf of Maine Aquarium, the Northeast Consortium, the Maine Outdoor Heritage Fund, the National Marine Fisheries Service, Canadian Department of Fisheries and Oceans, Northwest Marine Technologies and the Department of Inland Fish and Wildlife all made invaluable and much appreciated contributions to the herring tagging project.

For questions, comments or to request more information please contact Kohl Kanwit at the Department of Marine Resources, PO Box 8 W. Boothbay Harbor, ME 04575; (207) 633-9535; kohl.kanwit@maine.gov

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Stevenson, D.K., 2000. Status of the US Atlantic herring coastal stock complex and its smaller, but more heavily exploited component, the Gulf of Maine stock. *Herring 2000, the 18th Lowell Wakefield Symposium, Alaska Sea Grant*, p. 44b.

Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, 1998. 27th Northeast Regional Stock Assessment Workshop (27th SAW), Northeast Fisheries Science Center Reference Document 98-15

Appendix

The following is an outline of the pros and cons associated with different tag types and options for continuation of the project.

Pros and Cons

<u>Pros</u>	<u>Coded-wire Tags</u>	<u>Spaghetti Tags</u>
	recoveries easily traceable high volume of tags automated detection easier on the organism no reward system	recoveries from all sectors low-tech. no dissection of mass samples proven method less time intensive
<u>Cons</u>		
	very high tech. dissection/reading of tags recoveries from plants only extremely time intensive extensive staff resources trouble with false positives	recoveries rely on visual detection requires a reward system difficult to trace catch location of recoveries harder on the organism lower volume of tags (maybe)

Options

1. Repair damaged tag detector (maybe find funding for a second) and move forward with CWT program.

Discussion: The benefits and disadvantages of choosing this option are:

- No effort or learning specific to the CWT technology is lost
- All money earmarked for tagging can still be used
- Without 2 detectors only ~20% of catch is scanned requiring an increased sample size (from 60,000 to 120,000 fish)
- Connor's in Blacks Hbr. has decided not to have a detector
- Freezer plants pose new and significant problems for CWT detection

2. Convert tagging program from CWT to spaghetti tags and continue with project.

Discussion: The benefits and disadvantages of choosing this option are:

- Visible tags can be detected in all market sectors (bait and plants)
- All equipment/knowledge related to live fish handling can be used
- Much less time, money and staff needed to run the program
- All effort learning CWT technology specifically is lost
- About \$20,000 invested in CWT is unrecoverable

- Local support and expertise for spaghetti tag technique in DMR and St. Andrews DFO
- Project can operate on a long-term basis and include more partners

3. Discontinue tagging program entirely.

Discussion: The benefits and disadvantages of choosing this option are:

- Frees up staff time for other projects
- Lose all investments of time and money
- Important research would be abandoned
- Industry largely supports tagging